Department of Commerce $ National Oceanic & Atmospheric Administration $ National Weather Service

NATIONAL WEATHER SERVICE INSTRUCTION 10-806
JULY 4, 2005

Operations and Services

Aviation Weather Services, NWSPD 10-8

WORLD AREA FORECAST SYSTEM

NOTICE: This publication is available at: http://www.nws.noaa.gov/directives/.

OPR: OS23 (M. Mercer) **Certified by:** OS2 (L. Spayd)
Type of Issuance: Routine

SUMMARY OF REVISIONS: Supersedes NWSI 10-806, World Area Forecast System, dated July 16, 2004. Changes include:

Updated section 3, which contains a list of items the two WAFCs have agreed to as providers to the WAFS.

Updated section 4 and its subsections, which details specifics on products issued by the WAFCs.

Updated section 5, covering areas of responsibility.

Updated section 7, covering backup procedures.

Added a new portion to section 8, covering WAFS International Satellite Communications System. This results in renumbering Broadcast Schedule to subsection 8.1.

Updated section 9, Amendment Criteria, to show amendment criteria for High and Medium SIGWX charts. Section 9 has been combined with the former section 10, Amendment Procedures.

Updated section 10, Retention of Weather Documentation Materials. This was formerly section 9.

Deleted Appendix C, Operational Meteorology Message Formats.

//SIGNED// 6/20/2005
Dennis H. McCarthy Date
Director, Office of Climate, Water, and Weather Services

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1. Purpose. This instruction describes the World Area Forecast System (WAFS) and operational procedures and services provided by the Washington World Area Forecast Center (WAFC) in support of WAFS.

2. General. The WAFS was established by the International Civil Aviation Organization (ICAO) Communications/Meteorology (COM/MET) Divisional Meeting held conjointly with the seventh session of the World Meteorological Organization (WMO) Commission for Aeronautical Meteorology (CAeM) in Montreal, in 1982.

The Federal Aviation Administration (FAA) is the meteorological authority, as defined by ICAO, for the United States, and has agreed the United States will provide a WAFC within the WAFS framework. The FAA has designated the National Weather Service (NWS) as its meteorological provider, and in 1997 the NWS established the Washington WAFC.

3. World Area Forecast System and World Area Forecast Centers. The WAFS is a worldwide system which uses two WAFCs to provide aeronautical meteorological en-route forecasts in uniform and standardized formats. The two WAFCs are the Washington WAFC and the London WAFC. They have agreed to:

a. Prepare global grid point forecasts in standard format for all required levels and meteorological elements;

b. Prepare global forecasts of significant weather (SIGWX) phenomena in digital form;

c. Issue forecasts cited in a and b above to meteorological authorities and other users in their respective service area;

d. Prepare and issue amendments to the forecasts;

e. Include any information received from its associated WMO Regional Specialized Meteorological Center (RSMC) about accidental radioactive material release into the atmosphere in SIGWX forecasts; and

f. Establish and maintain contact with Volcanic Ash Advisory Centers (VAAC) so information exchanged on volcanic activity and eruptions can be included in SIGWX forecasts.

The Washington WAFC is composed of three centers: the National Centers for Environmental Prediction's (NCEP) Aviation Weather Center (AWC) in Kansas City, Missouri; the NCEP Central Operations (NCO) in Camp Springs, Maryland; and the Telecommunications Operations Center (TOC) at NWS Headquarters in Silver Spring, Maryland. Consistent with ICAO recommendations, the Washington WAFC issues wind and temperature forecasts in gridded format. Additionally, the Washington WAFC issues SIGWX forecasts in BUFR and T4 facsimile format. The T4 facsimile format will be issued only until November 30, 2006. These formats are described in the Manual on Codes, Annex II to the WMO Technical Regulations. Areas of coverage are in Appendix A.

In addition to providing WAFC forecast information, the WAFS satellite broadcasts also include aeronautical Operational Meteorological (OPMET) data. This allows the three satellite broadcasts to provide a cost effective means to achieve global exchange of this critical information.

As a supplement to the WAFC Washington service, Weather Forecast Office (WFO) Honolulu provides route forecasts (ROFOR), which are described in NWSI 10-811, Enroute Forecasts and Advisories. WFO Guam also provides two ROFORs to supplement WAFC Washington service. The routes are Majuro to Kwajalein and Majuro to Tarawa.

4. <u>World Area Forecast Center Information</u>. The information provided on WAFS broadcasts is defined in ICAO Annex 3, Meteorological Service for International Air Navigation, Chapter 3. This information is divided into four formats:

a. Grid point information in gridded binary (GRIB) format;

b. Facsimile information in T4 format;

c. SIGWX data information in BUFR format; and

d. OPMET information in character-oriented format.

The required areas, flight levels, and forecast times are established by Regional Air Navigation agreements, and listed in the applicable regional ICAO Air Navigation Plan.

4.1 Grid Point Data. Grid point data is prepared by WAFC Washington and coded in GRIB format (See the Manual on Codes, WMO Pub. No. 306, Volumes I.1 and I.2.). Users receiving this data must have a data processing system which can read, decode, and manipulate the data for the user's specific purpose.

WAFS products prepared in thinned GRIB format are a series of bulletins. Each bulletin contains a grid point field of one parameter at a single level, as a continuous bit stream sequence of bytes within a communications envelope. Part I - Technical description of the document titled "Gridded Binary (GRIB Code) Data on a "Thinned" Grid, from WAFCs London and Washington," describes the precise details of the data format.

WAFS thinned GRIB are on a grid 1.25° latitude x 1.25° longitude, with the points approximately 140 kilometers (KM) apart over the whole globe. The globe is divided into eight segments, four each in the Northern and Southern Hemispheres. Each segment is 90° in length, starting either side of the 30° W meridian, covering the Equator to each Pole. Decoding software available from WAFC Washington enables the information to be interpolated and presented on a regular latitude/longitude grid.

The gridded forecasts are prepared four times daily, valid for 6, 12, 18, 24, 30 and 36 hours after synoptic data time (0000, 0600, 1200, and 1800 UTC). They will be available for transmission in chronological order as soon as technically feasible, but no later than six (6) hours after the standard time of observation.

The grid point forecasts prepared by either WAFC should comprise:

Note: all altitudes are expressed as flight levels (FL) in hundreds of feet, followed by the corresponding pressure height in parentheses, measured as hPa:

a. Wind and temperature data for FL50 (850), FL100 (700), FL140 (600), FL180 (500), FL240 (400), FL300 (300), FL340 (250), FL390 (200) and FL450 (150);

b. Tropopause height and temperature, and direction, speed and height of maximum wind;

c. Humidity data for FL50 (850), FL100 (700), FL140 (600) and FL180 (500); and

d. Wind and temperature data for FL530 (100) and FL600 (70) when and where required.

4.2 Significant Weather T4 Charts. When SIGWX phenomena is supplied in chart form, the forecasts will be issued four (4) times daily, and valid at 0000, 0600, 1200, and 1800 UTC for the areas of coverage shown in Appendix A. The transmission of each forecast will be completed as soon as technically feasible but at least 12 hours before its valid time. The SIGWX forecasts will show, as appropriate to flight:

a. Thunderstorms;

b. Tropical Cyclones;

c. Severe squall lines;

d. Moderate or severe turbulence (in cloud or clear air);

e. Moderate or severe icing;

f. Widespread sandstorm/dust storm;

g. For FL100 to FL250, clouds associated with a. to f;

h. Above FL250, cumulonimbus cloud associated with a) to f);

i. Surface position of well-defined convergence zones;

j. Surface positions, speed and direction of movement of frontal systems when associated with significant enroute weather;

k. Tropopause heights;

l. Jetstreams;

m. Information on volcanic eruption locations producing ash clouds of significance to aircraft operations, including those producing only steam. This is depicted with a volcanic eruption symbol at the volcano's location, and at the side of the chart, the volcanic eruption symbol, the name of the volcano, latitude/longitude, the date and time of first eruption, if known, and a reminder users should check the latest Significant Meteorological Advisories (SIGMET) and Notices to Airmen (NOTAM) or Notices to Airmen for Volcanic Ash (ASHTAM) issued for the area concerned; and

n. Information on location of an accidental release of radioactive materials into the atmosphere, of significance to aircraft operations, comprising the radioactivity symbol at the accident's site, and at the side of the chart, the radioactivity symbol, latitude/longitude of the site of the accident, date and time of the accident and a reminder users should check the latest NOTAM for the area concerned.

4.3 Significant Weather BUFR Files. Forecasts of SIGWX phenomena will be issued using BUFR code form prescribed by WMO. (See the BUFR code form in WMO Publication No. 306, Manual on Codes, Volume I.2, Part B – Binary Codes). Forecasts of SIGWX prepared by WAFC Washington will be issued four times daily, valid at 0000, 0600, 1200, and 1800 UTC. The transmission of each forecast will be completed as soon as technically feasible but at least 12 hours before its valid time. Forecasts of SIGWX will include all the items listed in paragraph 4.2.2 above, and include global information between FLs 250 and 630, and between FLs 100 and 250 for limited geographical areas.

4.3.1 Significant Weather BUFR Description. BUFR is a standard binary format approved by the WMO for efficient storage of meteorological features, and includes all information needed to describe the SIGWX features. To produce a BUFR file, two elements are needed: a raw data file and a set of tables containing descriptors. When raw data is encoded, each data value is attached to a descriptor defining what the data represents. The decoding process reads the BUFR file, looks up the descriptor in the relevant table, and writes out the information in the proper format. Binary BUFR files contain a set of tables with descriptors. Descriptors must be decoded from a set of common tables on the local machine in order to understand what the values represent. To this end, BUFR messages are very small and machine independent. They can be understood and decoded by any BUFR decoder having the latest tables available.

SIGWX data in BUFR format is independent of the background or projection. Only the information describing the feature is encoded. For example, a CLOUD area is a list of points with the height of bases and tops, and cloud type and amount attributes attached. There are no rules on how the cloud area should be drawn, or how the attributes are displayed. On SIGWX charts this is shown as a box, sometimes with an arrow to the area but this information is determined by the graphical display program.

BUFR does not provide information on how to visually represent data. However, ICAO Annex 3 includes guidance on how meteorological features should be depicted on charts. SIGWX BUFR messages prepared by AWC use the following WMO headers:

High Level FEATURES	**COMMON NAME**	**WMO HEADER**
Jet streams	JETS	JUWE96 KKCI
Clear Air Turbulence	CAT	JUCE00 KKCI
Cumulonimbus	CLOUD	JUBE99 KKCI
Tropopause	TROP	JUTE97 KKCI
Frontal Systems	FRONTS	JUFE00 KKCI
Tropical Cyclones, Sandstorms and Volcanoes	V_T_S	JUVE00 KKCI

Mid Level FEATURES	**COMMON NAME**	**WMO HEADER**
SWM Tropopause height	M-TROP	JUOE00 KKCI
SWM jet streams	M-JETS	JUTE00KKCI
SWM fronts	M-FRONTS	JUJE00 KKCI
SWM cloud, in-cloud icing and turbulence	M-CLOUD	JUNE00 KKCI

SWM clear air turbulence	M-CAT	JUME00 KKCI

4.4 Operational Meteorological (OPMET) Information in Character-Oriented Format. OPMET information includes METARs, TAFs, SIGMET information and special AIREPs. Volcanic ash and tropical cyclone advisory messages will also be included on the broadcast.

When METARs or TAFs are intended for distribution in bulletin form, a WMO abbreviated header is added to the first line of message text to facilitate data compilation into appropriate bulletins. The WMO abbreviated header is described in document WMO No. 386 - Manual on the Global Telecommunication System.

4.5 WMO Regional Specialized Meteorological Centers (RSMC). The ICAO has recognized releases of radioactive materials and toxic chemicals pose a serious threat to aircraft operations in the atmosphere and at airports. As a result, RSMCs have been created to respond to these urgent matters. The RSMC Washington is a joint venture between the NOAA NWS National Centers for Environmental Prediction (NCEP) and the Air Resources Laboratory (ARL), merging NCEP's forecast skills and operational capabilities with ARL's pollutant dispersion modeling and analysis capabilities. NCEP's Senior Duty Meteorologist (SDM) is the 24-hour initial contact point for assistance requests.

In the event of an accident, NCEP operational staff will run the initial response model on the NCEP supercomputer and distribute the products in accordance with internal guidance via facsimile. Subsequently, ARL emergency responders are notified of the response and begin to work with NCEP and the RSMC Montreal to develop a joint statement of model differences. Model outputs should be distributed automatically to already-designated country representatives.

4.6 Volcanic Ash Advisory Centers. ICAO Volcanic Ash Advisory Centers (VAACs) are designated to provide advisory information to WAFCs and others regarding the lateral and vertical extent, and forecast movement of volcanic ash in the atmosphere following eruptions. This advisory information is used by WAFC Washington, in conjunction with SIGMET information, when including volcanic eruption information in SIGWX forecasts.

4.7 Tropical Cyclone Advisory Centers. ICAO Tropical Cyclone Advisory Centers (TCAC) are designated to provide advisory information to WAFCs and others on the position, forecast direction and speed of movement, central pressure, and maximum surface wind of tropical cyclones. This advisory information is used by WAFC Washington when including tropical cyclone information in SIGWX forecasts.

5. Areas of Responsibility. Unless specified in the ICAO regional Air Navigation Plans, the WAFS services area should be considered global. Notable exceptions to global service areas are associated with WAFS information produced in chart form. See Appendix A for maximum areas of coverage for information in chart form.

6. Use of Approved Contractions. All contractions and/or abbreviations used in WAFS forecasts prepared for international use will be taken from the Procedures for Air Navigation Services (PANS) - ICAO Abbreviations and Codes, Doc. 8400/5. All other words in the forecast

should be spelled out.

7. Backup. In case of interruption of WAFC operations, its functions will be carried out by the other WAFC. This includes any or all of the WAFS services as needed. WAFC London and WAFC Washington have studied a number of potential service interruption and outage scenarios, and agreed upon the appropriate responses to each interruption in service. These procedures can be found at http://www.icao.int/anb/wafsopsg.

8. WAFS International Satellite Communications System (ISCS) Broadcasts. WAFS broadcasts make Washington WAFC products, along with other supporting data for flight operations, available to as many WAFS users as possible within the satellite coverage area. The United States supports this requirement as a servicing WAFC with ISCS/WAFS. ISCS/WAFS is a point-to-multi-point delivery system serving as an additive component to the Aeronautical Fixed Telecommunication Network (AFTN). This system does not replace data acquisition and distribution functions of the ICAO/AFTN. The ISCS satellite coverage areas are shown in Appendix B. The remainder of world coverage is supported by the Satellite Distribution (SADIS)/WAFC broadcast provided by London WAFC. A complete list of ISCS broadcast content with abbreviated headings is provided at http://weather.gov/tg/iscsdat.html.

8.1 Broadcast Schedule. Information broadcast on ISCS will be disseminated as soon as it becomes available at the uplink. Therefore, the system does not operate with a strict timetable. However, the producer of the WAFS data should observe the following guidelines.

a. Transmission of SIGWX information should be completed as soon as possible, but at least 12 hours before its valid time.

b. Forecasts of upper winds; upper-air temperatures and humidity; direction, speed and height of maximum winds; and tropopause heights and temperatures should be available for the start of transmission in the above order and not later than 6 hours after standard time of observation.

c. OPMET information in alphanumeric format will be disseminated as soon as the messages are received. SIGMETs and special air reports are information of immediate concern to aircraft about to depart or in flight. These messages and volcanic ash and tropical cyclone advisory messages will be distributed without delay.

9. Amendments. Amendments for SIGWX forecasts will be issued with minimum delay in the form of amended BUFR files. Amendment criteria for SIGWX forecasts are:

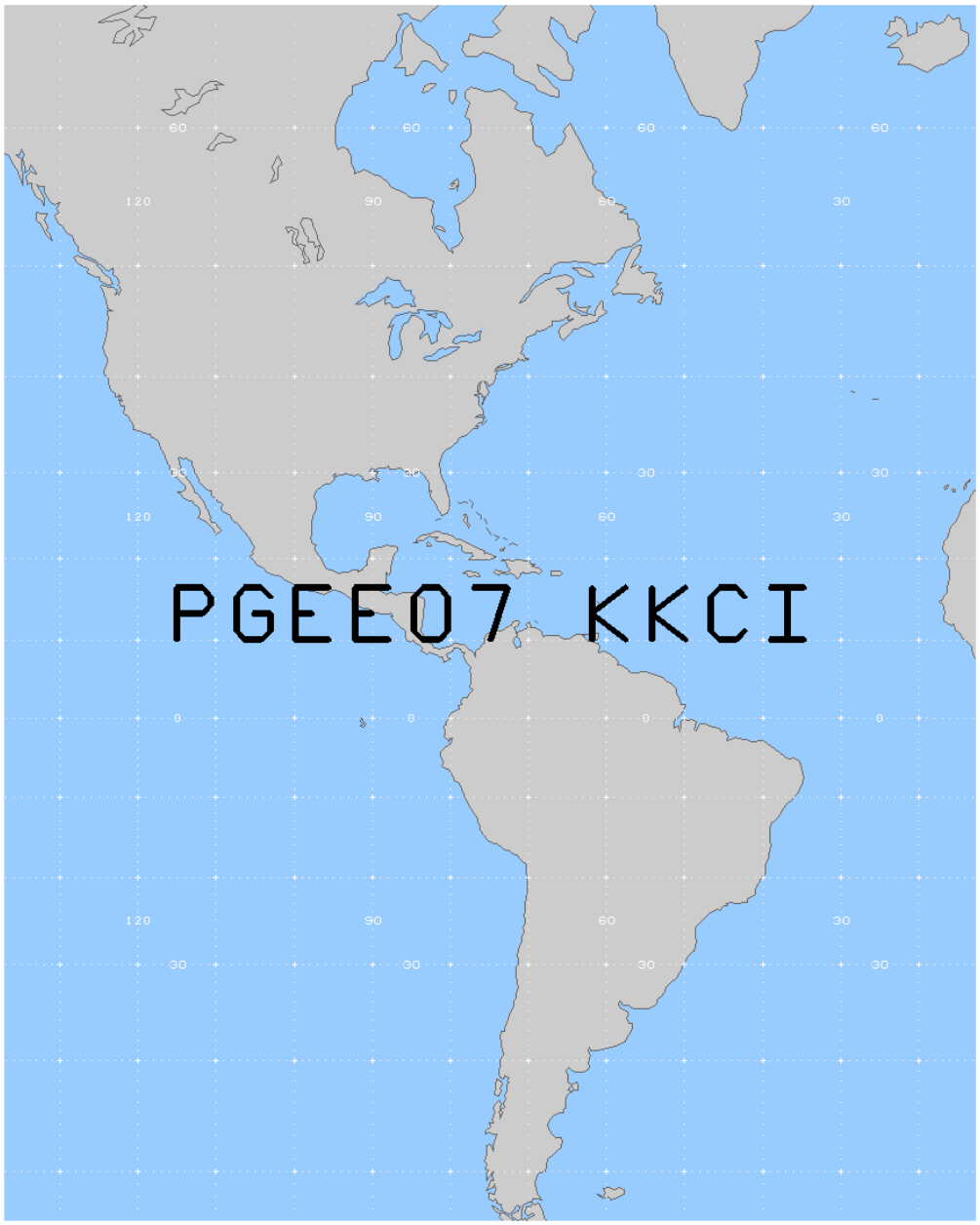
a. High level (FLs 250 to 630): Newly expected occurrence or non-occurrence of turbulence; occasional, frequent or embedded cumulonimbus; inclusion or removal of volcanic activity symbol; or radiation symbol.

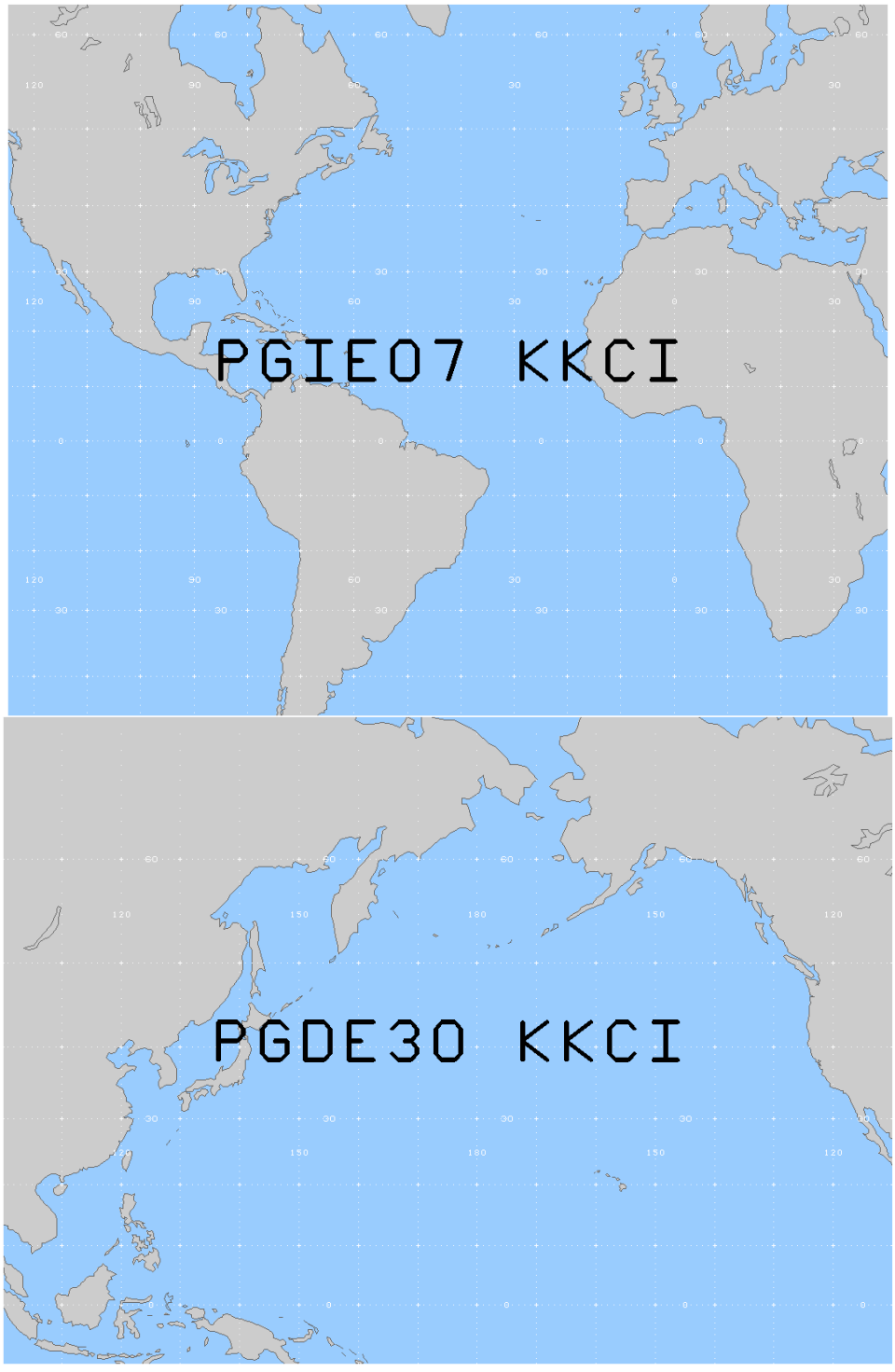
b. Medium level (FLs 100 to 250): Newly expected occurrence or non-occurrence of aircraft icing; turbulence; cumulonimbus; sandstorms/duststorms; and inclusion or removal of volcanic activity symbol or radiation symbol.

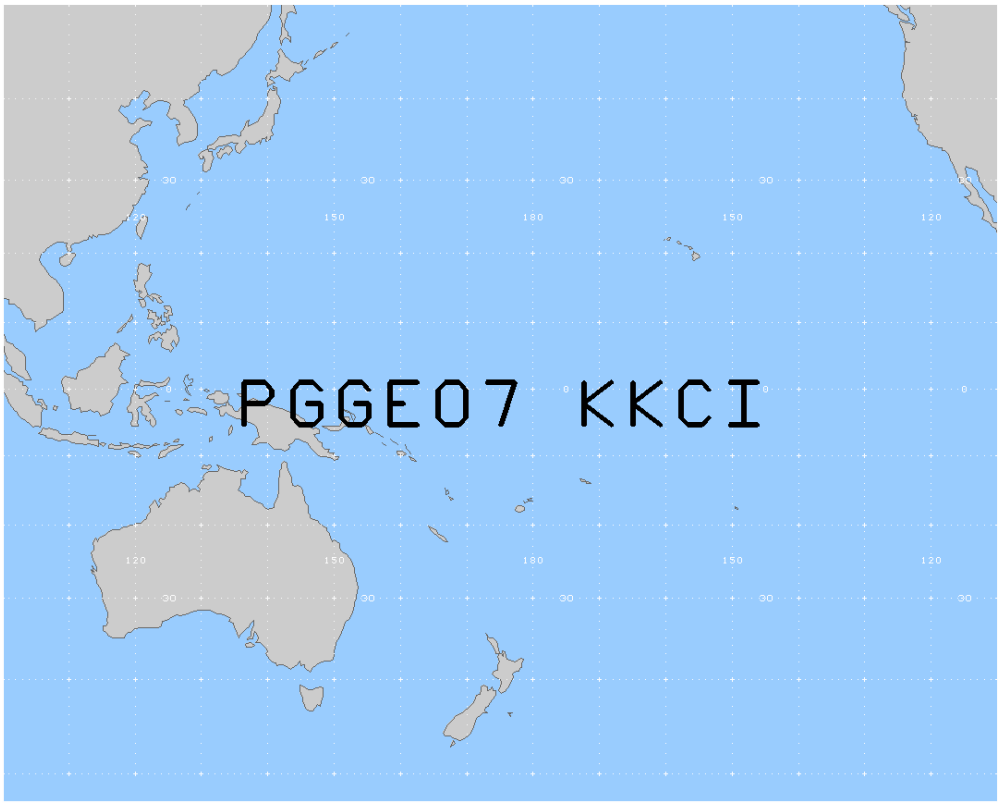
10. Retention of Weather Documentation Materials. In accordance with NWSI 10-2003, Records Retention, NWS forecast products will be electronically transferred to the National Climatic Data Center (NCDC) to meet retention requirements (five years). A limited short-term records retention responsibility resides at the originating NWS office. Each originating office will be able to electronically retrieve and print hard copies of their forecast products issued within the first 14 days of issuance. Offices should use caution in distributing copies of these records. However, if copies are distributed, a disclaimer indicating the records are not certified should be provided, along with contact information on how to obtain certified copies from NCDC.

Appendix A - Maximum Areas of Coverage

1. Maximum Areas of Coverage: Mercator Projection.

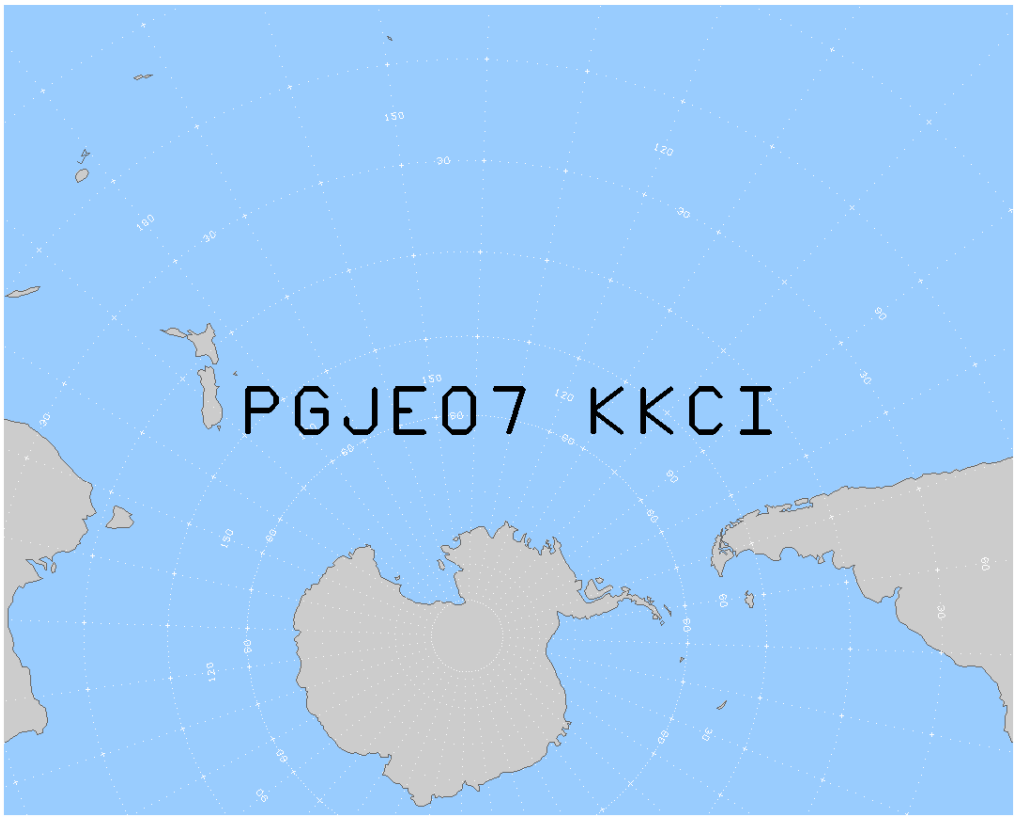



PGIE07 KKCI
PGDE30 KKCI



2. Maximum Areas of Coverage Polar Stereographic Projection.

3. Maximum Area of Coverage South Pole Polar Stereographic Projection



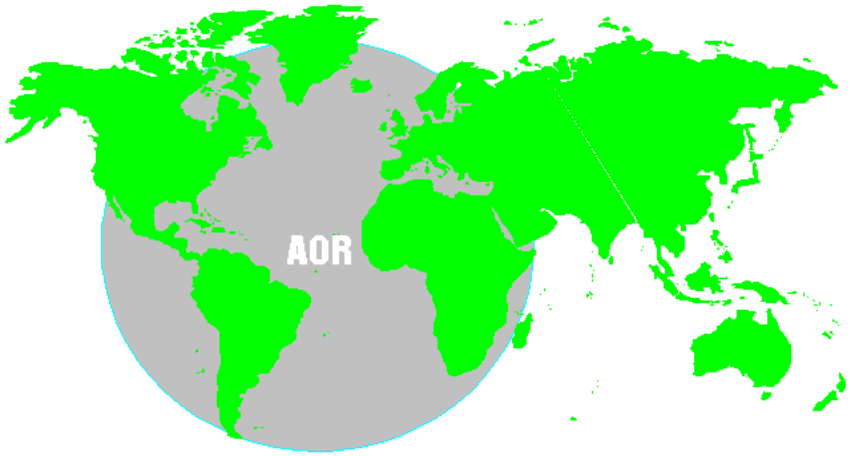
Appendix B - Footprints of WAFC Washington Satellite Broadcasts

U.S. National Weather Service
International Satellite Communications System

approximately 105 E to 110 W

Pacific Intelsat Coverage

U.S. National Weather Service
International Satellite Communications System



Approximately 110 W to 60 E

Atlantic Intelsat Coverage